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A REVIEW OF THE NEW WORLD
DILARIDAE

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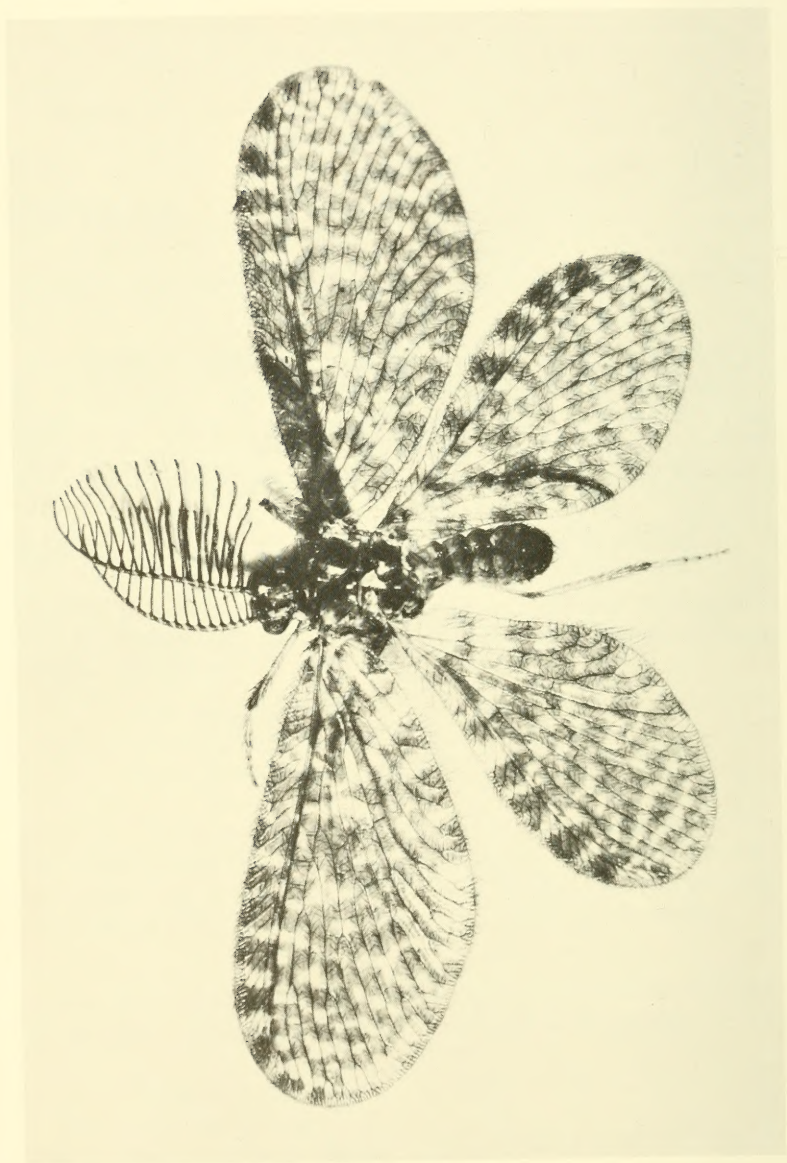


FIG. 1. *Nallachius limai*, n. sp., male, showing pectinate antennae characteristic of this genus.

A REVIEW OF THE NEW WORLD DILARIDAE

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(Received February 25, 1970)

ABSTRACT

Nallachiinae differs from Dilarinae in having non-homologous claspers and in structure of the vein, media anterior. *Neonallachius* Nakahara is referred to Dilarinae; *Nulema* Navás and *Neodilar* Carpenter are synonymized with *Nallachius*. No known exceptions remain to an exclusively Old World distribution for Dilarinae and a New World distribution for Nallachiinae. All New World species are listed; *Nallachius americanus*, *N. pulchellus*, *N. prestoni* and *N. loxanus* are illustrated, and the range of *N. americanus* is extended to Venezuela. New species are *Nallachius phantomellus*, *N. limai*, *N. ovalis* and *N. dicolor*, all from Brazil.

INTRODUCTION

This review of the New World dilarids, all members of the subfamily Nallachiinae, has been prompted by the discovery of specimens of four new species of this family from Brazil, in the Peabody Museum of Natural History. Since Navás' (1914) treatment of the Dilaridae, Carpenter (1940, 1947) has contributed importantly to an understanding of the New World fauna. However, males and females have been associated previously in only three species of Nallachiinae. The new material is of special interest in exhibiting more extreme sexual dimorphism in color and wing shape than had previously been known to occur in this family. In addition, examination of a large number of species has made possible evaluation of the utility of genitalic characters. Available type specimens have been examined, but considerations of time have prevented the general amassing of material that would have made a full-fledged revision possible.

ABBREVIATIONS

b—basal piece of MA; CuA—cubitus anterior; CuP—cubitus posterior; dl—dorsal lobe of ectoproct; dp—digitiform process of ectoproct; ect—ectoproct; gs—gonarcus; hy i—hyandrium internum; MA—media anterior; ml—median lobe of aedeagus; MP—media posterior; mu—mediuncus; R—radius; RS—radial sector; xv—crossvein; 8S, 8T—eight abdominal sternite and tergite; 9S, 9T—ninth abdominal sternite and tergite.

ACKNOWLEDGMENTS

Ellis G. MacLeod of the University of Illinois, Urbana, and the late Robert G. Beard, Cornell University, have been generous with the loan of specimens, and have offered helpful comments. Dr. D. E. Kimmins, British Museum (Natural History), Dr. S. Kelner-Pillault, Paris Museum, and Dr. Howard Evans, Museum of Comparative Zoology, Harvard University, have also graciously lent material for study. Most of this study was completed during my appointment as Visiting Associate Curator of Insects, Peabody Museum of Natural History, and was greatly facilitated by the assistance of Dr. Charles L. Remington. To all of these people I am most grateful.

METHODS OF STUDY

Male genitalia were cleared in KOH, stained with chlorazol black E and transferred to glycerine. The gonarcus and gonocoxites were partially separated from the tergites and sternites for more detailed examination. Because of the small size of this material, care was taken that the internal armature retain a connection to the remainder of the abdomen to prevent its loss during manipulation and transfer to the storage vial. The ectoprocts were positioned for drawing in the view most suited for showing the shape of the dorsal lobes and dorsal processes. In some cases this is a dorsolateral view; for a dorsal view, the abdomen was flattened under a glass chip. Examination with a compound microscope is essential. Drawings were produced with the aid of a camera lucida.

The female abdomen was similarly cleared and stained. I have not been able to see any important interspecific characters internally. The dorsal setiferous tubercles may have a distinctive shape, but these differences are so subtle that they are virtually valueless for use in taxonomy. Length of the ovipositor is the most useful feature; this was obtained by measuring a camera lucida drawing with dividers. A rough estimate of the ovipositor length relative to abdominal length may be obtained by flexing the ovipositor along the dorsum of the abdomen and noting upon which tergite the apex falls.

The photographs were made by Mr. A. H. Coleman and, with the exception of Figure 1, are all reproduced at the same scale.

SUBFAMILIAL CLASSIFICATION OF DILARIDAE

Two subfamilies of the Dilaridae, Nallachiinae (Nallachini Navás) in the New World and Dilarinae (Dilarini Navás) in the Old World, have generally been recognized, but the differences between them have not previously been clearly stated. According to Navás (1914), the two are separated as follows:

Espèces de l'ancien Continent. Champ sous-costal assez large, avec plusieurs veinules; toujours plus de quatre veinules entre le radius et son secteur; quelques veinules sur toute l'étendue des ailes, parfois disposées en gradin 1. Tribus Dilarini Navás.

Espèces américaines. Champ sous-costal étroit, sans veinules ou à peu près; moins de quatre veinules entre le radius et son secteur; très peu de veinules discales 2. Tribus Nallachini Navás.

Of these characters, only the geographical one now appears reliable. The width of the subcostal field is variable and may be quite broad in Nallachiinae. The number of "veinules" or crossveins between radius and radial sector is rarely more than three in *Nallachius*, but in the left forewing of the female allotype of *N. limai* there are nine radial crossveins. Usually Nallachiinae have fewer discal crossveins than have Dilarinae.

Carpenter (1947) considered size to constitute an important difference between Dilarinae and Nallachiinae: "The former are relatively large, with a wing expanse of 20 mm. or more, whereas the Nallachini have a wing expanse of less than 10 mm." This criterion no longer holds, especially with the larger females of Nallachiinae, as the following wingspreads demonstrate: *N. pulchellus*, an Arizona specimen in the Cornell University Collection, 18.3 mm; *N. ovalis*, 18.7 mm; *N. championi* (from original description), 22.5 mm. Carpenter mentions having noted genitalic and venational differences, but an account of these has unfortunately never been published.

An important character is the structure of the anterior media. The basal piece of MA usually joins the radial system near the wing base in the forewing of both subfamilies. In Dilarinae, the distal portion of MA diverges from R proximally to the base of RS, so that MA appears as a separate vein (Fig. 2B). *Rexavius marmoratus*, a dilarine, has MA as a free vein connected to R by a crossvein (Fig. 2A). Carpenter (1940) calls attention to a similar condition in *Dilar corcyracus* Navás; I have not seen this species. These are the only cases of which I am aware, in the forewings of modern insects, where a free MA is present. In Nallachiinae, MA is fused with RS basally, so that it appears as the proximal branch of that vein (Fig. 2C). In the hindwing of Dilarinae, the basal piece of MA typically is sinuous, joining RS distal to the separation of R and RS; whereas in the hindwing of Nallachiinae, the basal piece of MA is usually fused with R proximally to the origin of RS+MA or may be absent. The distal part of MA appears as a branch of RS in both subfamilies.

In male Dilarinae, several apical flagellar segments may lack elongate lateral processes, while Nallachiinae usually have only one or two, but never more than three, such "unarmed" segments.

The most significant difference between these two subfamilies concerns the male terminalia. In the few Dilarinae where the genitalia are known, the ectoprocts are reduced and their clasping function is transferred to the modified ninth tergite (Acker, 1960; Aspöck and Aspöck, 1967). The internal apparatus consists of a gonarcus with laterally articulated gonocoxites and two submedially articulated mediuncus lobes. The arrangement of the internal armature thus closely resembles that of the Osmylidae (Adams, 1970). In the Nallachiinae, the ectoprocts are normally developed, often with a pair of modified dorsal lobes abutting on a modified ninth tergite (Fig. 9). In addition to possessing gonocoxites and mediuncus lobes similar to those of the Dilarinae, a median sclerite (Fig. 9C, *ml*) is present, articulated on the gonarcus. The gonopore is located immediately beneath this median sclerite, resulting in a configuration closely resembling that of coniopterygids such as *Coniopteryx* (see Tjeder, 1957, figs. 93, 94). The proximity of the median sclerite to the gonopore indicates that the former may be a remnant of an

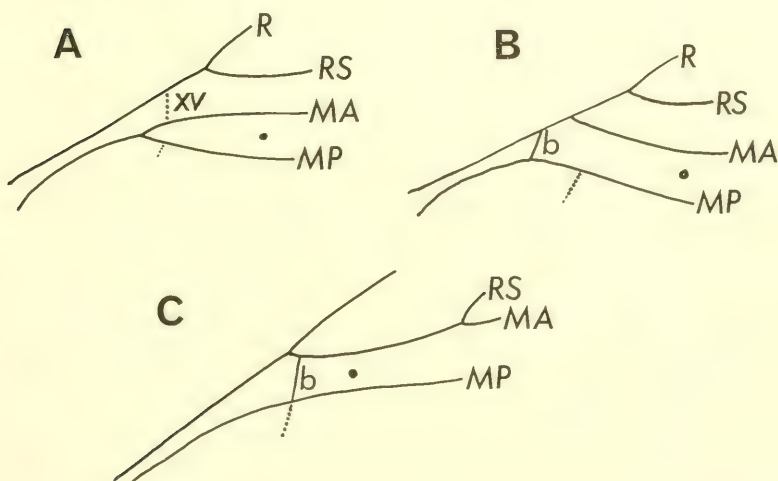


FIG. 2. Evolution of media anterior in the forewing of Dilaridae: A) Media anterior (MA) is a free branch of media, connected only by a crossvein to the radial system (*Rexavius marmoratus* Banks, type); B) MA bends upward to contact R, as in most Dilarinae; C) MA appears as a branch of RS, as in Nallachiinae.

aedeagus, as considered to be by Carpenter (1947). Since I have not observed a comparable structure in Raphidiodea or Sialodea, I suspect that it may be a specialized, rather than a primitive feature. For the time being, it appears preferable to refer to this structure by the morphologically neutral term, "median lobe." Acker (1960) mistakenly identified the median lobe as the hypandrium internum (his "tenth sternite") overlooking the presence of the inconspicuous true hypandrium internum lying on the wall of the gonoduct near the gonopore (Fig. 4C, *hy i*).

In summary, male terminalia of the two subfamilies appear to differ in having non-homologous claspers and a median process present in Nallachiinae but absent in Dilarinae. Until the genitalia of the Dilariinae have been more extensively explored, the reliability of these differences cannot be assessed with assurance.

GEOGRAPHIC DISTRIBUTION

Exceptions to the formerly neat geographical restriction of the Dilarinae to the Old World, and Nallachiinae to the New World are seemingly provided by *Neodilar* Carpenter, a supposed New World dilarine, and *Neonallachus* Nakahara, a supposed Old World nallachiine.

Carpenter referred *Neodilar* to the Dilarinae principally because of its large size (wing expanse 25 mm) and the extensive secondary branching of the veins. As noted above, size is not a reliable criterion; indeed the wing spread of female *Neodilar* exceeds that of female *Nallachus championi* (Navás) by only 2.5 mm. The secondary branching consists of inward extension of the marginal twiggings; this probably does not represent a fundamental change in venational pattern but only a response to increased size. Similarly broad wings and increased secondary branching are demonstrated to a somewhat lesser extent by *Nallachus limai*, a probable close relative. Most importantly, in *Neodilar* MA does not diverge directly from R in the forewing as in most dilarines, but coalesces basally with RS as in *Nallachus*; the basal piece of MA is absent from both anterior and posterior wings of *Neodilar*, as is often the case in Nallachiinae. Furthermore, *Neodilar hermosa* has fewer discal cross-veins than do most dilarines. The coloration and details of body proportion are similar to those of most Nallachiinae. The emargi-

nate black labrum resembles that of *Nallachius limai*, which also has a closely similar wing shape and venational pattern. Certainly then there is no basis for assigning *Neodilar* to the Dilarinae. Moreover, I have been unable to discover any reason for separating *Neodilar* from *Nallachius*.

Neonallachius Nakahara, 1963, is more problematical. This tiny insect (forewing 3 mm) is smaller than any *Nallachius* I have seen, including an *N. americana* from Puerto Rico, in the Cornell University Collection which has a 3.6 mm forewing. Its venation is so reduced as to indicate nothing concerning its taxonomic position. The antennal flagellum, however, bears only relatively short projections, and these are entirely absent on the five apical segments. Both of these features are common in Dilarinae but unknown in Nallachiinae. It is difficult to make much of the male genitalia, as figured by Nakahara (1963). In the lateral view of the abdominal apex, there is no callus cerci shown, nor is a separate ninth tergite shown in addition to the claspers. Apparently the claspers correspond to the ninth tergite, as in other Dilarinae. The figure of the "tenth sternite" (=gonarcus, etc.) shows a pair of gonocoxites laterally and a bilobed median process which probably represents fused mediuncus lobes. All known Nallachiinae have separated mediuncus lobes in addition to the median structure. The only described features of *Neonallachius* possibly consistent with assignment to the Nallachiinae are the small size and correlated aberrant reduced wing venation, but these conditions could as well have been attained in a dilarine. Until evidence is produced to the contrary, genitalic and antennal structure adduce assignment of *Neonallachius* to the Dilarinae.

The earlier generalization therefore still seems valid, that the Dilarinae are restricted to the Old World and the Nallachiinae to the New World.

SUBFAMILY NALLACHIINAE NAVÁS

Nallachini Navás, 1914, Gen. Insectorum 156: 11.

Nallachiini Carpenter, 1947, Psyche 54: 100.

This taxon has previously been treated as a tribe. I consider the genitalic characters sufficiently distinct from those of Dilarinae to warrant subfamilial separation. The sole included genus is *Nallachius*.

Nallachius Navás

Nallachius Navás, 1909, Mem. R. Acad. Cienc. Barcelona 7: 665; 1914, Gen. Insect. 156: 11; Carpenter, 1940, Proc. Amer. Acad. Arts Sci. 74: 272–275; 1947, Psyche 54: 100–109. Type: *Dilar prestoni* McLachlan, designated by Navás, 1914.

Nulema Navás, 1914, Gen. Insect. 156: 12. Type, by original designation, *N. championi* Navás 1914. **New synonymy** (subjective).

Neodilar Carpenter, 1947, Psyche 54: 107. Type, by original designation, *Dilar hermosa* Banks. **New synonymy** (subjective).

DESCRIPTION. Male antennae monopectinate, female antennae filiform. Vertex and dorsum of thorax and abdomen with conspicuous setiferous tubercles. Basal piece of MA in forewing appears as crossvein between MP and R before origin of RS+MA, sometimes absent. In hindwing, basal piece of MA is sinuous, joining RS after separation of RS from R, often weakly developed or absent. MP2 coalesced with CuA in several species, usually free. Ninth tergite normal; ectoprocts with a series of medial lobes, usually a dorsal lobe and a digitiform process. Gonarcus arcuate with narrow dorsal shelf; gonocoxite variously developed, articulated on gonarcus. Mediuncus lobes separate, elongate, articulated on base of slender sclerotized median lobe; beneath median lobe lies the gonopore.

DISCUSSION OF SYNONYMY

According to Navás, *Nulema* differs from *Nallachius* in having two unarmed flagellar segments rather than one, in having numerous (16) very long flagellar processes and in lacking discal crossveins in

the apical half of the wing. The number of unarmed flagellar segments varies; most species of *Nallachius* have only one, but the type of *N. ovalis* has two on the left side and one on the right; *N. americanus* may have three. The number and length of the flagellar processes vary; the large number in *Nulema championi* is probably a correlate of its size and is equalled by *Nallachius limai*. The number of discal crossveins is also variable; *Nallachius americanus* alone of the species I have examined lacks these in the apical half of the wing, thus resembling *Nulema*.

None of the characters used by Navás serves generically to differentiate *Nulema championi* from the other species of *Nallachius*. Mr. D. E. Kimmins has been kind enough to examine the male type; the genitalia have not been cleared, but the form of the ectoproct is like that of *N. prestoni*, the type species of *Nallachius*. Inasmuch as the ectoproct furnishes the most distinctive taxonomic characters in the *Nallachiinae*, *Nulema* must be considered a synonym of *Nallachius*.

Neodilar Carpenter, 1947, is based upon *Dilar hermosa* Banks, 1913, known from a single female. The only differences from *Nallachius* are the larger size, more extensive branching of veins and broader wings. If one considers the range of diversity now known for *Nallachius*, continued recognition of *Neodilar* appears unjustified. The possibility remains, however, that the male may prove distinctive; consequently the synonymy must be regarded as provisional.

BIOLOGY AND GEOGRAPHIC DISTRIBUTION

MacLeod and Spiegler (1961) have reviewed what is known of the biology of *Nallachius americanus*, the only member of the genus whose immature stages are known. Most larvae were taken under "tightly adherent bark of erect, recently dead trees," *Quercus* and *Liriodendron*. Two were found in older, more-decayed wood, and two adult females were taken on the stump of a much-decayed, crumbling Virginia Pine. In the laboratory they successfully fed the larvae a variety of soft, disabled insect larvae and eggs.

N. americanus appears to be non-specific in its requirements for kind or condition of wood or kind of prey and is the most wide-ranging species, occurring widely in the Eastern deciduous forests of the United States, in Puerto Rico and in Venezuela. *N. pulchellus* also shows a wide range, being known from Cuba and southern

Arizona; probably it will appear in Central America when more collecting is done there. The other species are all known from single localities, including two nearby localities for *N. limai*, but very possibly will also prove to have extensive distributions. Greatest diversity occurs in the area of Paraguay and southeastern Brazil where seven species are known. Guatemala, Colombia, Ecuador and Argentina have one species each. In Latin America, all the localities are hilly or mountainous; there are no known species from the Amazon basin. This may merely reflect collecting intensity.

Emergence time seems to be during the summer. In the northern hemisphere, most records occur from May to August; the single September record is from Woodville, Texas. Southern hemisphere records are mostly for October through January, with one record for September and one for March.

TAXONOMIC CHARACTERS

Wing venation in Nallachiinae is highly variable with respect to number of vein branches and position of forks, and to number and location of crossveins. More useful are characters dealing with proportion, such as overall shape of the wing and the relative areas occupied by the various major veins. Width of the costal area and presence of forking of costal veinlets are especially critical. Coalescence of MP2 with CuA occurs in several member species: *N. loxanus*, *N. pupillus*, *N. americanus*, *N. hermosus*. Of these, only *N. americanus* is known from more than a single specimen; I have not seen any examples that lack this feature, nor have I seen any examples of fusion of these veins among other species where series have been available. However, in view of the excessive venational variation exhibited by these insects, this character should probably be regarded with suspicion. Females are generally somewhat larger with more slender, paler wings.

In the male terminalia, the most important differences are in the shape of the posterior border of the ninth abdominal tergite and in development of a pair of dorsomedial ectoproct lobes which I term the dorsal lobe and the digitiform process. Shape of the gonocoxite and the relative lengths of the mediuncus lobes and the median lobe of the gonarcus may also be distinctive. In the *pulchellus* group especially (*vide infra*), differences are extremely subtle; between the species pairs *N. ovalis* and *N. bicolor*, *N. prestoni* and *N. reductus*,

I was unable to discern any differences whatever in the male genitalia.

The species of this genus comprise several indistinctly differentiated subgroups:

A. The *pulchellus* group. Venation varied, MP2 not coalesced with CuA in forewing, wings usually elongate, subtriangular. Labrum pale, dorsal lobe of ectoproct well-developed, digitiform process ordinarily with small blunt medial spine. 1. *N. phantomellus*, 2. *N. pulchellus*, 3. *N. reductus*, 4. *N. prestoni*, 5. *N. dicolor*, 6. *N. ovalis*, 7. *N. championi*.

B. The *limai* group. Wings broad, rounded, much secondary branching of longitudinal veins. In *N. hermosus*, MP2 briefly coalesced with CuA. Labrum dark. Genitalia as in *N. pulchellus* group. 8. *N. limai*, 9. *N. hermosus* (male unknown).

C. The *americanus* group. MP2 fused with CuA in forewing; digitiform process reduced, dorsal lobe of ectoproct not clearly developed. 10. *N. americanus*, 11. *N. loxanus*, 12. *N. pupillus* (male unknown).

D. Incertae sedis. 12. *N. bruchi*.

KEY TO THE SPECIES OF NALLACHIUS (MALES)

1. In forewing, MP2 fused with CuA, costal veinlets simple (Fig. 14) 2
 In forewing, MP2 not fused with CuA, some costal veinlets occasionally forked 4
2. Wing apex rounded, nearly symmetrical about long axis (Paraguay) *N. pupillus* Navás
 Wing apex plainly asymmetrical, posterior margin angulate 3
3. More than 2 radial crossveins in forewing; several crossveins between branches of RS in both wings, genitalia as in Fig. 14 *N. loxanus* Navás
 Only 2 radial crossveins in forewing, no crossveins between branches of RS in either wing; genitalia as in Fig. 13. North America, and south to Venezuela
 *N. americanus* (McLachlan)

4. Male antennae with 16 elongate processes *N. championi* (Navás).
Male antennae with 14 or less elongate processes 5
5. Labrum black, wings rounded *N. limai* n. sp.
Labrum pale, wings more elongate 6
6. Dorsal lobe of ectoproct inflated, costal veinlets simple
..... *N. pulchellus* Banks
Dorsal lobe of ectoproct flat 7
7. Dorsal lobes of ectoprocts approximated on midline 8
Dorsal lobes of ectoprocts widely separated in middle 9
8. Costal area wider, most distal costal veinlets forked
..... *N. ovalis*, n. sp.
Costal area narrow, most costal veinlets simple
..... *N. bicolor*, n. sp.
9. Subcosta nearly straight, costal area narrow, many costal veinlets forked *N. prestoni* (McLachlan)
Subcosta curved posteriad at stigma, costal area wider, few costal veinlets forked *N. reductus* Carpenter

The description of *N. bruchi* Navás is insufficient for inclusion of that species in the key. The male of *N. hermosus* is unknown; this large species has MP2 fused with CuA, forked costal veinlets, black labrum. I have not seen *N. championi*.

Nallachius phantomellus, new species

Figures 3, 4

DESCRIPTION. Male antennae white, fragile, crumpled in dried material, slightly longer than head and thorax, ten elongate processes. Labrum pale, flat, deeply incised. Head, legs and body yellowish white, setae entirely pale. Wings pale (Figs. 3A, B), two broad irregular transverse pale brown bands of which the apical is more prominent. Anterior margin straight, costal space narrow, subcostal



FIG. 3. *Nallachius phantomellus*, n. sp., male above, female below.

veinlets unbranched in male, a few branched in female. Two radial crossveins, five unforked branches of RS; MA deeply forked. Male genitalia (Fig. 4) similar exteriorly to those of *N. dicolor*, but digitiform process more cylindrical, bearing a slender hook on medial surface. Gonocoxites shorter than in *N. dicolor*, lateral edge angulate so that shape resembles scimitar, with tip bent dorsally. Mediuncus lobes short, spatulate, hardly bent ventrad, with prominent lateral projections. Median process ends at level of these lateral projections.

MEASUREMENTS (mm). Forewing length: male 4.6, 4.7; female 9.2, 8.5, 7.5.

TYPES. Holotype male, Rio Caragualà, Brazil, 21°48'S–52°27'W, 400 m, March 1963, leg. Fritz Plaumann, Peabody Mus. Nat. Hist. (Yale). Allotype and paratypes, same data, one male, three females, Peabody Museum.

REMARKS. This species is immediately recognizable by the pallid coloration, the extremely narrow costal space, especially in the hind wing, and the male genitalia.

Nallachius pulchellus (Banks)

Figure 5

Dilar (Nallachius) pulchellus Banks, 1938, Rev. de Ent., Rio de Janeiro 9: 289.

Nallachius pulchellus Carpenter, 1940, Proc. Amer. Acad. Arts Sci. 74: 274; 1947, Psyche 54: 104. Stange, 1961, Pan-Pac. Ent. 37: 144.

REDESCRIPTION. The male of this species is readily distinguished by the bladder-shaped dorsal ectoproct lobes and the incised margin of the ninth tergite (Fig. 5). The gonocoxites are slender, unspecialized apically, and the mediuncus lobes downcurved, bluntly rounded apically, with lateral projections on surface of adjoining membrane. The labrum is pale, flat, with undulating margin.

TYPE. Male, Central Soledad (near Cienfuegos) Cuba, 4 May, 1930, leg. P. J. Darlington, Mus. Comp. Zool. No. 22681 (examined).

Additional material: previously recorded from the Santa Rita and Huachuca Mts., Arizona. New record, Onion Saddle Rd., .7 mi. SE. E. Turkey Cr., Chiricahua Mts., Cochise Co., Ariz., on knoll, 6500 ft., 13 July, 1969, at u.v. light, leg. R. G. Beard.

Nallachius reductus Carpenter

Figure 7

Nallachius reductus Carpenter, 1947, Psyche 54: 104–106.

TYPE. Italyria, Paraguay, October, leg. F. Schade, male, MCZ 27664 (examined). Carpenter's citation of the type locality as "Ualyaia" was no doubt due to misinterpretation of Banks' rather unclear script on the locality label. I have been unable to ascertain the position of this locality:

REMARKS. Carpenter's figure shows a space between the dorsal lobe and the digitiform lobe of the ectoproct, but I have not been able to observe this (Fig. 7). The digitiform process bears no medial hook. The gonocoxites are slender, with a short hook apically. The genitalia are like those of *N. prestoni*, which *N. reductus* resembles closely. In *N. reductus*, fewer costal veinlets are forked than in *N. prestoni*, the forewing is more pointed and the costal area of the hind wing is much broader.

Nallachius prestoni (McLachlan)

Figure 6

Dilar prestoni McLachlan, 1880, Ent. Mo. Mag. 17: 39.

Nallachius prestoni, Navás, 1909, Mem. Acad. Cienc. Barcelona 7: 667; 1911, Ann. Soc. sci. Bruxelles 35: 221; 1914, Genera Insectorum 156: 11; 1930, Rev. Chilena Hist. Nat. 34: 63. Carpenter, 1940, Proc. Amer. Acad. Arts Sci. 74: 273; 1947, Psyche 54: 102–103, fig. 1.

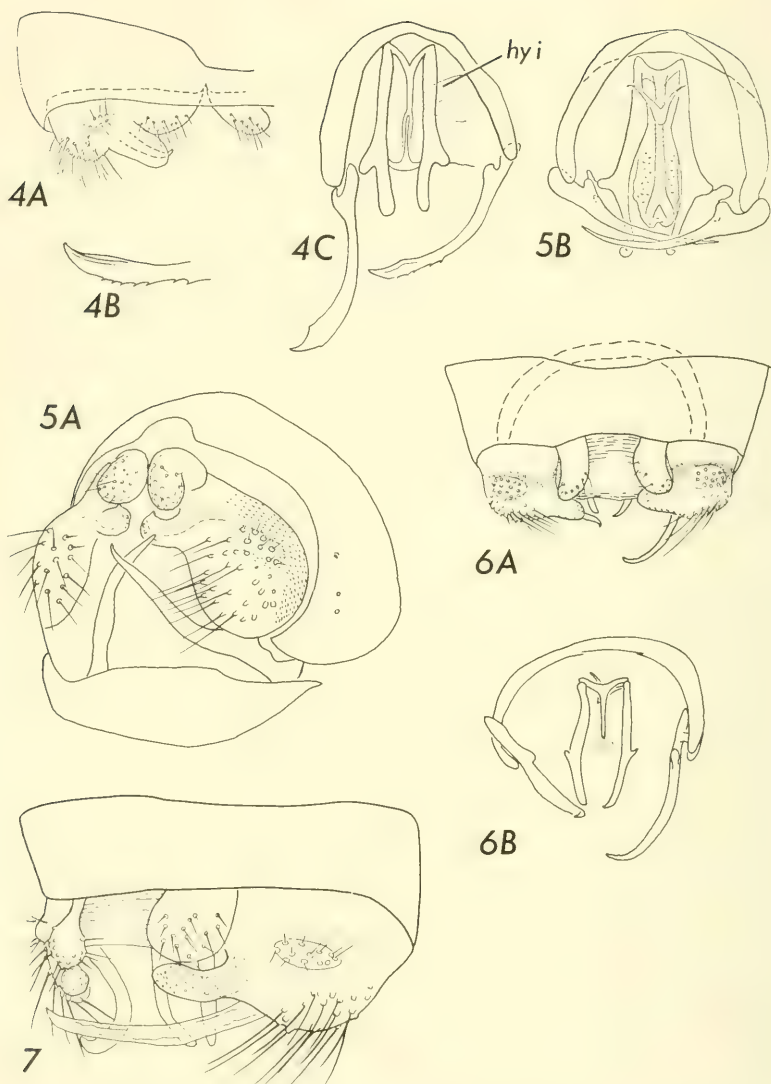


FIG. 4. *Nallachius phantomellus*, n. sp.: A) abdominal apex, dorsal; B) apex of gonocoxite, lateral; C) internal genital armature, dorsal, same scale as 4A.

FIG. 5. *Nallachius pulchellus*: A) abdominal apex of holotype, posterolateral; B) internal genital armature, ventral (Arizona).

FIG. 6. *Nallachius prestoni*, holotype: A) abdominal apex, dorsal; B) internal genital armature, dorsal.

FIG. 7. *Nallachius reductus*, holotype, abdominal apex, dorsolateral.

TYPE. "Rio, Preston 11/72. McLachlan Coll. B. M. 1936-674. Dilar Prestoni M. L." Abdomen in balsam.

REMARKS. The venation of this species is accurately figured by Carpenter (1947). The dorsal lobes of the ectoprocts are widely spaced, and the gonocoxites are slender with no blade-like expansion (Fig. 6B). I can see no differences between the genitalia of this species and those of *N. reductus* Carpenter. However, the wings are of a markedly different shape in these two species, as Carpenter's figures clearly show, so they undoubtedly are distinct. In general appearance, *N. prestoni* is much like *N. bicolor*, but the genitalia differ.

***Nallachius ovalis*, new species**

Figure 11

DESCRIPTION. Male antennae moderately crumpled when dry, 8-9 projections, unarmed distal flagellar segments two in type, one in paratype. Labrum pale, margin slightly emarginate, surface concave. Head pale, frons and vertex brown, vertex tubercles paler. Thoracic dorsum brown, mesoscutum pale medially, pleurae and legs pale. Male forewing broad, rounded, costal veinlets inclined, spaced about one-fourth their length apart, mostly forked on distal half of wing. Two radial crossveins, RS five-branched, the last shallowly forked. MP2 and CuA1 not coalesced. 1A runs at an angle to wing margin, without long pectinate series of marginal veinlets as in *N. bicolor*. Hind wing also broad, basal piece of MA weakly developed, fuses with R before origin of RS+MA. Wings colored similarly to those of *N. bicolor*, but dark spots larger, especially on anterior margin, and a greater area of the wing is pale. Female wing more slender and paler than that of male, with about six dark spots on costal area of forewing; remainder of wing surface almost uniformly covered with grey tessellated pattern. Male genitalia as in *N. bicolor*. In female, ovipositor long, extends to fourth tergite when flexed forward.

MEASUREMENTS (mm). Forewing length, male 5.5; female 7.3-7.5; ovipositor 2.8-3.2.

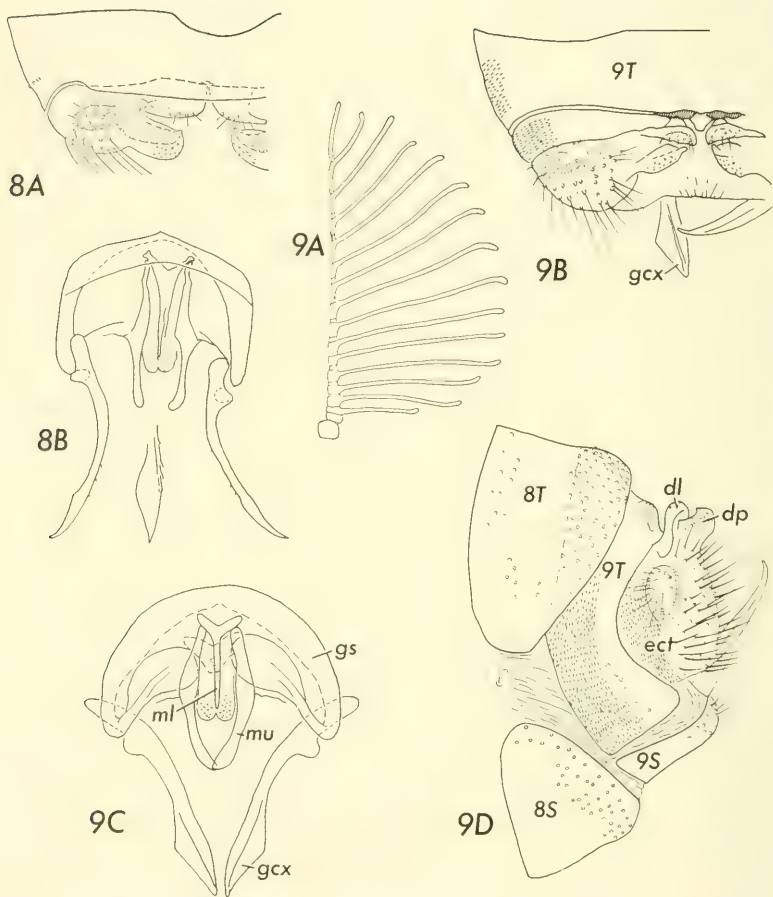


FIG. 8. *Nallachius dicolor*: A) abdominal apex, dorsal; B) internal genital armature, dorsal.

FIG. 9. *Nallachius limai*, n. sp.: A) male antenna; B) abdominal apex, dorsal; C) internal genital armature, dorsal; D) abdominal apex, lateral. Setal bases shown by small circles; dashes on 9T and ectoproct indicate pore fields, present on all known species.

TYPES. Holotype male, Nova Teutonia, Santa Catarina, Brazil, 27°11'5–52°23'W, 300–500 m, Oct. 1963, leg. Fritz Plaumann, Peabody Mus. Nat. Hist. (Yale). Allotype, female, same data, 5 Dec. 1965 or 1966, E. G. MacLeod Coll.

PARATYPES, same data: male, Oct. 1966, E. G. MacLeod Coll.; female, Oct. 1963, Peabody Museum.

REMARKS. Resembles *N. dicolor*, but wing is darker and broader, so that costal veinlets are spaced less than twice their length apart. In the forewing, 1A runs at an angle to margin, not parallel to it as in *N. dicolor*. The ovipositor of *N. ovalis* is longer, extending to the middle of the fourth tergite when bent forward.

***Nallachius dicolor*, new species**

Figures 8, 10

DESCRIPTION. Male antennae flexible, crumpled in dry material, either one or two terminal segments of flagellum without long processes; eight, nine or sometimes ten processes present. Labrum pale, weakly emarginate, anterior surface concavely angulate. Head fuscous; anterior vertex tubercle larger than two posterior tubercles, which nearly touch on midline. Body fuscous, paler beneath.

Male wings (Fig. 10, top) with membrane mostly brown; about six pale spots in costal area of forewing; smaller pale spots scattered uniformly over surface. Wing triangular, costal space narrow; costal veinlets more than half their length apart, few forked. RS with four or five branches, the last forked. MP2 not coalesced with CuA in forewing. Basal piece of MA not developed in hindwing.

Female wings (Fig. 10, bottom) more slender and paler than those of male; about six large brown spots in costal area, smaller spots scattered over wing surface, denser basally.

Male genitalia. Posterior margin of ninth tergite unmodified, dorsal lobes of ectoprocts small, flat, approximated on midline; digitiform lobe with stout hook protruding near apex (Fig. 8A). Gonocoxites lancet-shaped, curved outward; mediuncus lobes slender-ligulate apically; median process wide basally, apex bilobed, projecting beyond lateral processes of mediuncus lobes (Fig. 8B).



FIG. 10. *Nallachius bicolor*, n. sp., male above, female below.



FIG. 11. *Nallachius ovalis*, n. sp., male above, female below.

Ovipositor extends to middle of sixth tergite when flexed anteriorly.

MEASUREMENTS (mm). Male forewing length 4.3–(5.0)–5.2 ($n=11$); female forewing length 5.1–(6.6)–7.9 ($n=8$), ovipositor length, 1.65–(1.98)–2.2.

TYPES. Holotype male, Nova Teutonia, Santa Catarina, Brazil, 27°11'S, 52°23'W, 17 Oct. 1956, leg. F. Plaumann, Peabody Mus. Nat. Hist. (Yale). Paratype males, same locality, 1 Sept. 1948, 16 Nov. 1949, 18 Sept. 1956, 29 Sept. 1956, 12 Oct. 1956, 7 Dec. 1956, 19 Jan. 1957, 18 Oct. 1957, Peabody Museum. Allotype, same locality, 6 Oct. 1944, Peabody Museum; paratype females same locality, 12 Oct. 1944, 31 Sept. 1956, 1 Oct. 1956, 22 Oct. 1956, 29 Nov. 1956, 3 Oct. 1957, 19 Oct. 1959. Peabody Museum.

REMARKS. The name of this species is derived from the remarkable sexual dimorphism in wing color. Although similar in appearance to *N. bicolor*, *N. prestoni* differs in the following ways: 1A does not extend so far toward the wing apex, it has a flat labrum, the dorsal ectoproct lobes are separated medially, and it lacks the lancet-like expansion of the gonocoxites.

***Nallachius championi* (Navás), new combination**

Nulema championi Navás, 1914, Gen. Insect. 156: 12.

LECTOTYPE. Male, Guatemala, Cerro Zunil, [14°44'N, 91°27'W] 4–5,000 ft., leg. Champion, Brit. Mus. Nat. Hist. (not seen). A pair of specimens, male and female, is in the British Museum. Navás did not designate either as type, so I now designate the male as **lectotype**.

REMARKS. As pointed out above, there appears to be no significant difference between *Nallachius* and *Nulema*. D. E. Kimmins has examined the male type; the ectoprocts are formed as in the *pulchellus* or *limai* group (personal communication). The wings of both sexes are illustrated by Navás. This is a large species (wing expanse of female, 22.5 mm; of male, 16 mm) with distinctive wing markings.

Nallachius limai, new species

Figures 1, 9, 12

Nulema sp., Lima, 1943, Insetos do Brasil 4:80, figs. 52, 53 (male).

Nallachius (?) *prestoni*, Lima, 1943, not McLachlan 1880, Insetos do Brasil 4:82, figs. 54, 55 (female). Carpenter, 1947, Psyche 54: 103. Gurney, 1947, Psyche 54: 148.

DESCRIPTION. Male antennae (Figs. 1, 9A) about as long as head and body, 14–16 segments with stiff branches which curl only slightly at ends. Labrum black, margin incised, anterior surface flat. Head pale, frons and vertex broadly fuscous, vertex tubercles pale, anterior tubercle about same size as posterior tubercles. Thorax and abdomen fuscous.

Wings. Male wings (Fig. 12, top) rounded, broader and darker than those of female, the anterior margin of forewing convex, costal space broad, many subcostal veinlets branched. Radial crossveins, 3–5, RS with 5–6 main branches; posterior two branches of RS and MA, also branched. CuA not fused with MP2 in either wing. Male hindwing rounded, costal space broad, costals mostly forked, 2–3 radial crossveins, basal piece of MA indistinct distally. Wing membrane white, a group of about 8 large dark spots on costal area, remainder of wings uniformly covered with confluent spots and transverse streaks so that about 2/3 of wing surface is dark.

Female wings (Fig. 12, bottom) much more elongated than in male, costal margin nearly straight in middle; in forewing, 6–7 radial crossveins, RS with four main branches of which the posterior two and the MA are deeply branched.

Male genitalia. Apical margin of ninth tergite with dark submedian sclerites and median ventrad projection (Fig. 9B). Dorsal lobe (*dl*) of ectoproct cupped with anterior tooth contacting sclerotized area of ninth tergite; digitiform process (*dp*) flattened, posterior margin angulate, apical tooth prominent (Fig. 9D). Gonocoxite blades (Fig. 9C) lancet-shaped, mediuncus lobes apically downcurved and angulate, median lobe bifid apically, gonarcus curved, its upper surface membranous with indistinctly sclerotized plates arising from postero-lateral corners.



FIG. 12. *Nallachius limai*, n. sp., male above, female below.

MEASUREMENTS (mm). Male forewing length 6.6, 6.2, antennae 2.94, female forewing length 8.9.

TYPES. Holotype: Male, Nova Teutonia, Brazil, 27°11'S–52°23'W, 300–500 m., Dec. 1968, leg. Fritz Plaumann, Peabody Mus. Nat. Hist. (Yale). Paratypes, same locality: Male, Terias de la, 2 Jan. 1966, Peabody Museum; male, Nov. 1966, E. G. MacLeod Coll.: female, 1 Nov. 1966, E. G. MacLeod Coll. Additional paratype: Male, Neu Bremen, Santa Catarina, Brazil, 8 Mar. 1937, leg. Fritz Hoffman, Cornell Univ.

REMARKS. The male is easily recognized by the broadly rounded wings, the unusually large stiff antennae and the distinctive genitalia. The female differs from *ovalis*, *dicolor* and *pulchellus* in having a wider costal space, branched subcostals, rounder wing tips and black labrum. In the broad, rounded wings, wide costal area, numerous forkings of longitudinal veins, and black labrum, this species resembles *Nallachius hermosus* (Banks).

Lima (1943) probably concluded that the male of this species was a *Nulema* because of the numerous antennal processes. A photograph of the female is captioned by him as *N. (?) prestoni*; his failure to associate the two sexes is understandable in view of the highly dimorphic wing shape.

***Nallachius hermosus* (Banks), new combination**

Dilar (Nallachius) hermosa Banks, 1913, Trans. Amer. Entomol. Soc. 39: 220.

Neodilar hermosa, Carpenter, 1947, Psyche 54: 108–109, fig. 5 (wings).

REDESCRIPTION. Labrum deeply emarginate, thin, dark-pigmented. Wingspread of female 25 mm; extensive secondary branching of MP produces a bulge in hind margin of both wings. MP2 briefly anastomosed with CuA. Body color yellow, wings pale, brown-tessellated. Male unknown.

TYPE. Pacho, E. Cordilleras, Colombia, elev. 6600 ft., Oct., leg. Fassl, female (examined).

REMARKS. In shape and color of labrum, and complexity of venation, this species most closely resembles *N. limai*.

***Nallachius americanus* (McLachlan)**

Figure 13

Dilar americana McLachlan, 1880, Entomol. Mo. Mag. 18: 55. Banks, 1905, Trans. Amer. Entomol. Soc. 32: 24.

Nallachius americanus, Navás, 1909, Mem. Real Acad. Cienc. Artes Barcelona 7: 669; 1914, Gen. Insect. 156: 11. Carpenter, 1940, Proc. Amer. Acad. Arts Sci. 74: 273–274; 1947, Psyche 54: 106–107, fig. 4. Gurney, 1947, Psyche 54: 147–169 (photo of wing; larva). Stange, 1961, Pan-Pac. Entomol. 37: 144. MacLeod and Spiegler, 1961, Proc. Entomol. Soc. Washington 63: 281–286 (development).

REDESCRIPTION. Carpenter has illustrated the wing venation (1947) and male genitalia (1940). The ninth abdominal tergite may bear a triangular projection on its posterior border (Fig. 13C). The ecto-

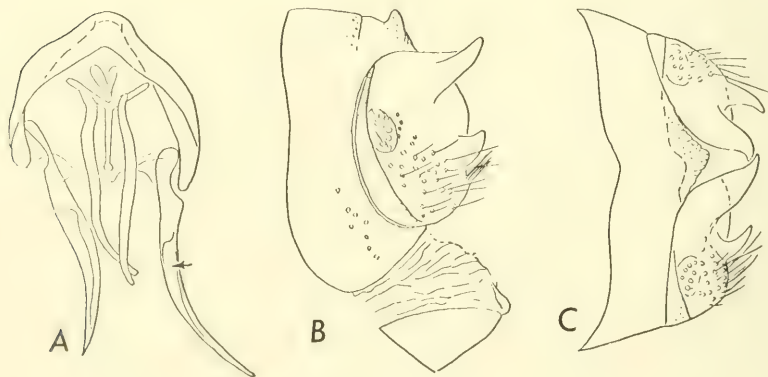


FIG. 13. *Nallachius americanus*: A) internal genital armature, dorsal, showing slender gonocoxites with groove (arrow); B) abdominal apex, lateral, showing widely spaced marginal hooks and unusual configuration of ectoproct; C) abdominal apex, dorsal, showing median projection of ninth tergite (stippled).

procts are highly distinctive, with prominent angular-margined dorsal lobes, widely separated from the ligulate lobe which probably corresponds with the digitiform process of the other species. In most specimens except those from Michigan, ventrally to this ligulate lobe is a small, dorsally directed hook with an apical tuft of setae. The gonocoxites are slender, pointed, with a deep longitudinal depression (Fig. 13A); the median process is unusually short.

TYPE. Bee Spring, Kentucky, June, 1874, leg. Sanborn, female, MCZ No. 10434.

DISTRIBUTION. This is the most wide-ranging species of *Nallachius*, previously recorded from Michigan, Kentucky, Virginia, Maryland, Texas and Puerto Rico. I have seen a male from Archbold Biol. Station, Lake Placid, Highlands Co., Florida, 30 March 1959, leg. J. G. Francelemont, Cornell Univ. The following material is the southernmost record for the species: Rancho Grande, 7 km. N. of Maracay, Aragua Province, Venezuela, 1100 m., Aug. 15, 1967, at mercury vapor light, leg. R. W. Poole, 2 males, R. Beard Coll.

***Nallachius loxanus* Navás**

Figure 14

Nallachius loxanus Navás, 1911; Ann. Soc. sci. Bruxelles 25: 219; Carpenter 1947, Psyche 54: 107.

REDESCRIPTION. Labrum pale, incised medially; anterior vertex scar well separated from posterior scars and twice their diameter; head light brown, vertex scar paler. Antennae missing. Thorax light brown, paler medially, pronotal tubercles pale. Wings pale with uniformly distributed small light brown spots, the diameter of each about the same as intervein distance; pale spaces between them also approximately equal to intervein distance. Right wing venation as in Fig. 14D. MP2 is fused with CuA in both forewings. Left forewing: four radial crossveins, seven branches of RS+MA; hindwing: six branches of RS+MA.

Male genitalia (Fig. 14A, B, C). Posterior margin of ninth tergite angulate. Ectoproct subtriangular, with spatulate digitiform process,

posterior to which is a shallow depression; dorsal lobe absent. Gonocoxites slender, no apical expansion, mediuncus lobes also slender, tips rounded.

HOLOTYPE. Male, "Museum Paris, Equateur, Loja, A. Poujade, 1904." "*Nallachius loxanus* Nav.," (in Navás' hand). "H. & U. Aspöck vid. 1967."

MEASUREMENT. Forewing length 6.7 mm.

REMARKS. The male genitalia most nearly resemble those of *N. americanus* (Fig. 13) in shape of ninth tergite and specialization in

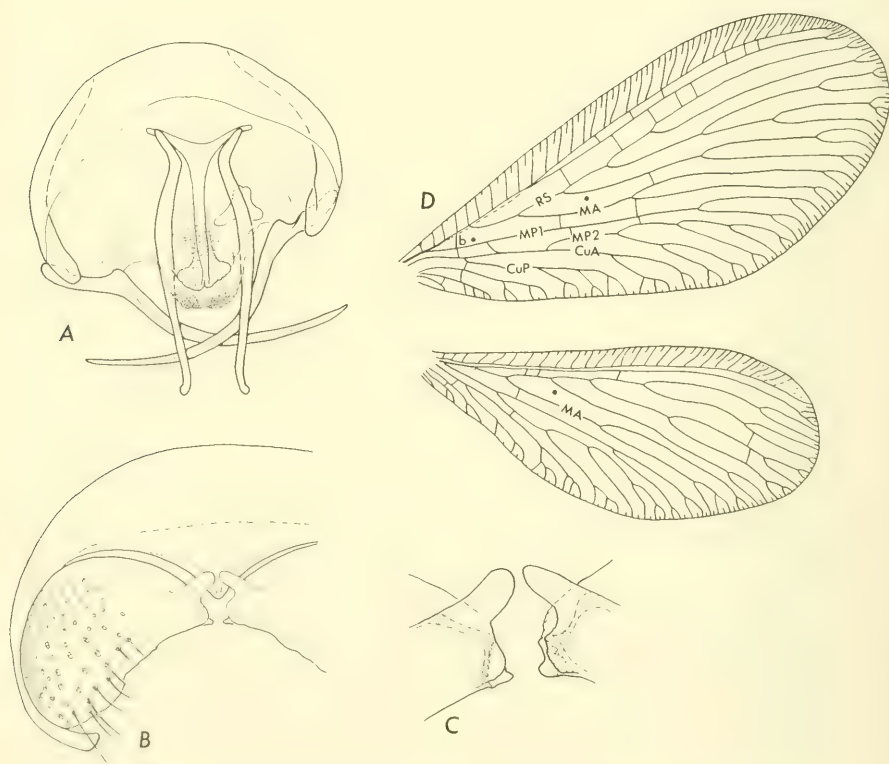


FIG. 14. *Nallachius loxanus*: A) internal genital armature, dorsal; B) abdominal apex, dorsal; C) apices of ectoprocts more enlarged; D) wing venation, forewing reconstructed from a composite drawing.

the area of dorsal lobe and digitiform process. Fusion of MP2 and CuA in the forewing also occurs in *N. americanus*; it appears probable that these species are related.

The species is known only by the type, of which the right forewing had been broken off at the base and reattached with acetate cement, causing some longitudinal folding and obscuring of the base. Consequently, Fig. 14D is a composite of camera lucida drawings from several aspects, with the anterior half of the extreme base taken from the left wing.

***Nallachius pupillus* (Navás), new combination**

Nulema pupillus Navás 1930, Rev. Chilena Hist. Natural 34: 62–63, fig. 11.

TYPE. Male, "Paraguay, San Bernardino" [25°16'S, 57°16'W, ca. 700 ft. elev.] "36.1, H. Fiebrig."

REMARKS. The unique type of this species was in the Hamburg Museum and presumably has been destroyed. Navás' drawing shows an oval forewing; MP2 is fused with CuA. Small size (forewing length 4.2 mm) is correlated with reduced venation; only three branches of RS, in addition to MA, are indicated. The only apparent reason for originally referring this species to *Nulema* is the lack of discal crossveins beyond the middle of the wing; the antennae have only a single unarmed segment instead of two, as is supposedly characteristic of *Nulema*.

***Nallachius bruchi* Navás**

Nallachius bruchi Navás, 1923, Arxius l'Inst. Cienc. Barcelona 7: 195. Carpenter, 1947, Psyche 54: 104.

The type, a female from Alta Gracia, Córdoba, Argentina, was deposited in the Navás collection. No illustration is given and the description is inadequate to permit inclusion of this species in the key. Probably MP2 has not anastomosed with CuA ("procubito prope basim furcato"), and a series of five gradate crossveins is present.

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